

UNPUBLISHED PRELIMINARY DATA

FORDHAM UNIVERSITY
Department of Chemistry

SEMI-ANNUAL STATUS REPORT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION RESEARCH GRANT NsG-341

July 12, 1963

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Investigations of the nature of the meteorite microstructures (i.e. "organized elements") and of organic matter in carbonaceous meteorites are being conducted in connection with research project NsG-341. Particular emphasis is placed on attempts to evaluate the degree of terrestrial contamination of the meteorite samples. The Orgueil carbonaceous meteorite samples that are studied were received from the Montauban Museum in France and from the U.S. National Museum in Washington, D.C. Non-carbonaceous meteorites and other control samples were received from other collections and investigators.

Electron probe x-ray microanalysis of organized elements revealed the presence of approximately 30% iron as an average (often associated with some chlorine). Other organized elements contained silicate compounds. Finding particles of elaborate morphologies showing these chemical compositions, both in powdered preparations and in petrographic thin sections of the Orgueil meteorite, seems to suggest that the organized elements that were studied were not terrestrial contaminations. Orgueil samples that were boiled in 6N HCl for an hour prior to analysis revealed microstructures that contained no elements that were detectable ($Z > 11$) by the microprobe that was used. These acid resistant residues were most likely composed of carbonaceous matter. The results of these studies have been published (Nature, 1963,

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vol. 198, pp. 121-125). Investigations that are now being conducted with the cooperation of other investigators and with suitably modified electron probe microanalysers show that carbon may be present in organized elements. This latter finding has to be confirmed and evaluated through the examination of more meteorite samples and of proper controls.

Preliminary work with the electron microscope revealed microstructures of distinct morphologies in the ultrathin sections of HCl treated Orgueil samples. This work will continue to evaluate the findings and to develop better techniques for the electron microscopic examination of organized elements.

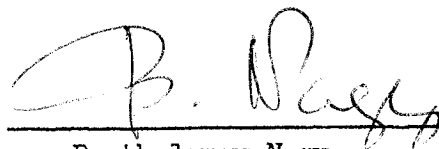
The examination of the ultraviolet absorption spectra of individual organized elements with the ultramicrospectrograph, made possible through the courtesy of Prof. T. Caspersson of the Karolinska Institute in Stockholm, revealed absorption bands at 265 mμ and 280 mμ wavelengths. Soluble iron compounds were first removed from the organized elements with oxalic acid, silicates with HF and some organic matter with chloroform. The exact cause of the UV spectral features is not yet known, although it is possible that they are caused by nucleic acids and proteins which absorb at the same wavelengths. The intensity of the ultraviolet absorption spectra of the 0.5N HCl insoluble residues of organized elements in a petrographic thin section was reduced after an overnight exposure to a solution of the enzyme, ribonuclease. This further suggests the possible presence of nucleic acids in the organized elements. The ultramicrospectrographic examination of a Feulgen stained particle also indicated the presence of nucleic acids as it appeared from spectral evidence that the color was caused by the real

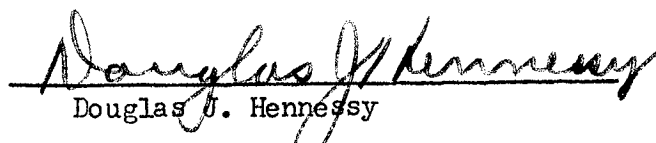
Feulgen reaction when spectral comparisons were made with cell standards. Further investigations will be necessary to properly evaluate the results of the ultramicrospectrographic studies.


The examination of the bituminous organic matter in the Orgueil meteorite is continued with current emphasis on branched-chain fatty acids (The results of the analysis of straight-chain fatty acids have been published in Arch. Biochem. Biophys. 1963, vol.101, pp. 240-248). A method for separating branched-chain fatty acids from straight-chain and cyclic ones by urea and thiourea adduction is now being developed. Some branched-chain fatty acids are synthesized to serve as controls for this study.

The optical rotation of the fatty acid and also of water-dispersable, non-dialysable fractions of the Orgueil meteorite has been examined at various wavelengths with Rudolph spectropolarimeters. The measurements were conducted at two independent laboratories. The fatty acids, or more properly acidic fractions were prepared by the Soxhlet extraction of approximately 10 g samples of the Orgueil meteorite with a 6:4 mixture of benzene-methanol, followed by saponification of the extract with KOH, and by extraction with water, acidification and reextraction with ether. The acidic fractions of the Orgueil meteorite thus obtained showed a slight levo-rotation (-0.020 ± 0.003 degrees) in the vicinity of 440 mμ wavelength. Below this spectral range the solution was not transparent and above this range optical rotation appeared to be absent. Identically prepared acidic fractions from ragweed pollen grains, from dust in the Montauban Museum and from soil appeared to be opaque at 440 mμ and dextro-rotatory at higher wavelengths. The optical activity measurement will be continued in order to properly evaluate the findings.

Investigations have begun on thin layer chromatographic techniques using optically active stationary and mobile phases with the view of developing a method for detecting the presence of optically active materials when present in minute quantities in extracts of sedimentary rocks and carbonaceous chondrites.


Bartholomew Nagy


Douglas J. Hennessy


George Claus

UNITED STATES GOVERNMENT

Memorandum

TO : ATSD-O/Irv Lebow

DATE: JUN 24 1964

FROM : ATSS-A/Head
Acquisitions and Dissemination Section

SUBJECT: Removal of availability limitations

The Facility should be instructed to remove the availability limitations from the following documents. These documents should be recycled through the system for re-evaluation and assignment of N-numbers.

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